WHAT IS CLAIMED IS:

1. A system for generating electrical power for supply to a load, comprising:

a gas turbine engine comprising:

a first spool including a first shaft, a first compressor mounted on the first shaft, a first turbine mounted on the first shaft, and a combustor operable to combust or react a mixture of fuel and compressed air from the first compressor to produce hot gases that are expanded in the first turbine to produce mechanical power to drive the first compressor; and

a second spool including a second shaft and at least a second turbine mounted on the second shaft, the second turbine arranged to receive gases exhausted from the first turbine and expand the gases to produce mechanical power, the second spool being rotatable independently of the first spool;

a main generator coupled to one of the first and second spools so as to be rotatably driven thereby, the main generator operable to generate an alternating electrical current for supply to the load; and

an auxiliary generator/motor coupled to the other of the first and second spools, the auxiliary generator/motor selectively operable in either a generation mode or a motor mode, the auxiliary generator/motor in the generation mode being operable to extract mechanical power from the spool to which the auxiliary generator/motor is coupled and generate an alternating electrical current for supply to the load, the auxiliary generator/motor in the motor mode being operable to receive electrical power from a source and convert the electrical power into mechanical power that is injected into the spool to which the auxiliary generator/motor is coupled.

2. The system of claim 1, further comprising a controller structured and arranged to control operation of the main generator and the auxiliary generator/motor.

3. The system of claim 2, further comprising a power electronics unit coupled with the main generator and with the auxiliary generator/motor, the power electronics unit operable to process the alternating currents from the main generator and auxiliary

generator/motor and synthesize an alternating output current at a fixed predetermined frequency for supply to the load.

4. The system of claim 3, wherein the power electronics unit comprises a first rectifier structured and arranged to operate upon the alternating current from the main generator so as to produce a first non-alternating direct current at a non-alternating voltage, a second rectifier structured and arranged to operate upon the alternating current from the auxiliary generator/motor so as to produce a second non-alternating direct current at a non-alternating voltage, and an inverter structured and arranged to operate upon the non-alternating direct currents from the rectifiers so as to synthesize the alternating output current that is supplied to the load.

5. The system of claim 4, wherein the first rectifier is responsive to a current control signal to vary the level of the first non-alternating direct current independently of the alternating current from the main generator, the controller being operable to supply the current control signal to the first rectifier to control the level of the first non-alternating direct current output by the first rectifier and thereby control main generator speed.

6. The system of claim 1, further comprising a heat exchanger arranged to receive the compressed air from the first compressor and exhaust gases from the second turbine, the heat exchanger causing heat transfer from the exhaust gases to the compressed air so as to pre-heat the compressed air prior to combustion in the combustor.

7. The system of claim 6, wherein the combustor comprises a catalytic combustor.

8. The system of claim 7, further comprising a sensor operable to measure a variable indicative of combustor inlet temperature, and wherein the controller is connected to said sensor and is operable to control air flow through the first spool in such a manner as to maintain the combustor inlet temperature above a predetermined minimum temperature required for catalytic operation.

9. The system of claim 8, further comprising a sensor associated with the heat exchanger operable to measure a variable indicative of a temperature of the exhaust gases entering the heat exchanger, and wherein the controller is connected to said sensor associated with the heat exchanger and is operable to control air flow through the first spool to maintain the temperature of the exhaust gases entering the heat exchanger below a predetermined maximum temperature.

10. The system of claim 1, wherein the second spool includes a second compressor that is mounted on the second shaft and is driven by the second turbine, the second compressor being arranged to compress air and supply the compressed air to the first compressor, which further compresses the air.

11. The system of claim 10, wherein the main generator is coupled with the first spool and the auxiliary generator/motor is coupled with the second spool.

12. The system of claim 11, further comprising an intercooler arranged between the second compressor and the first compressor, the intercooler being operable to cool the compressed air from the second compressor before the compressed air is supplied to the first compressor.

13. The system of claim 11, further comprising a heat exchanger arranged to receive the compressed air from the first compressor and exhaust gases from the second turbine, the heat exchanger causing heat transfer from the exhaust gases to the compressed air so as to pre-heat the compressed air prior to combustion in the combustor.

14. The system of claim 10, wherein the main generator is coupled with the second spool and the auxiliary generator/motor is coupled with the first spool.

15. The system of claim 1, wherein the second turbine comprises a free power turbine.

16. The system of claim 15, wherein the main generator is coupled with the second shaft for the free power turbine and the auxiliary generator/motor is coupled with the first shaft.

17. A method for operating an electrical generation system having a multi-spool gas turbine engine comprising at least first and second spools, the first spool including a first shaft, a first compressor mounted on the first shaft, a first turbine mounted on the first shaft, and a combustor operable to combust or react a mixture of fuel and compressed air from the first compressor to produce hot gases that are expanded in the first turbine to produce mechanical power to drive the first compressor, the second spool including a second shaft and at least a second turbine mounted on the second shaft, the second turbine arranged to receive gases exhausted from the first turbine and expand the gases to produce mechanical power, the second spool being rotatable independently of the first spool, the method comprising the steps of:

providing a main generator coupled with one of the first and second spools so as to be driven thereby, the main generator operable to generate an alternating current;

providing an auxiliary generator/motor coupled with the other of the first and second spools, the auxiliary generator/motor selectively operable in either a generation mode or a motor mode, the auxiliary generator/motor in the generation mode being operable to extract mechanical power from the spool to which the auxiliary generator/motor is coupled and generate an alternating electrical current for supply to the load, the auxiliary generator/motor in the motor mode being operable to receive electrical power from a source and convert the electrical power into mechanical power that is injected into the spool to which the auxiliary generator/motor is coupled;

causing the auxiliary generator/motor to operate in a selected one of the generation and motor modes; and

controlling operation of the auxiliary generator/motor in the selected mode so as to affect an operating condition of the gas turbine engine.

18. The method of claim 17, wherein the causing step comprises causing the auxiliary generator/motor to operate in the generation mode so as to extract power from and slow down the spool to which the auxiliary generator/motor is coupled.

19. The method of claim 18, wherein the controlling step comprises regulating the rotational speed of the auxiliary generator/motor so as to regulate the rotational speed of the spool to which the auxiliary generator/motor is coupled.

20. The method of claim 17, wherein the causing step comprises causing the auxiliary generator/motor to operate in the motor mode so as to inject power into and speed up the spool to which the auxiliary generator/motor is coupled.

21. The method of claim 20, wherein the causing step is performed during a start-up of the gas turbine engine, the auxiliary generator/motor serving as a starter.

22. The method of claim 17, further comprising the step of regulating the rotational speed of the main generator so as to regulate the rotational speed of the spool to which the main generator is coupled.

23. The method of claim 22, wherein the regulating step comprises rectifying the alternating current from the main generator in an active current-controlled rectifier operable to convert the alternating current into a non-alternating direct current, and regulating the level of the direct current so as to regulate the rotational speed of the main generator.

24. The method of claim 23, wherein the main generator is coupled with the first spool and the auxiliary generator/motor is coupled with the second spool, the second spool including a second compressor mounted on the second shaft and arranged to compress air and supply the compressed air to the first compressor, and further comprising the steps of:

operating the auxiliary generator/motor in the generation mode so as to alter the mechanical power produced by the second spool; and

regulating the operation of the auxiliary generator/motor so as to regulate the rotational speed of the first spool.

25. The method of claim 24, wherein the rotational speeds of the first and second spools are controlled, via regulation of the main generator and auxiliary generator/motor, such that an efficiency of the engine is substantially maximized.

26. The method of claim 24, comprising regulating the rotational speeds of the first and second spools, via regulation of the main generator and auxiliary

generator/motor, so as to lower an operating line of at least one of the compressors on a compressor map thereof and thereby avoid a surge region of the map.

27. The method of claim 24, wherein the engine includes a heat exchanger arranged to receive the compressed air from the first compressor and exhaust gases from the second turbine, the heat exchanger causing heat transfer from the exhaust gases to the compressed air so as to pre-heat the compressed air prior to combustion in the combustor, the method further comprising the step of regulating the rotational speeds of the first and second spools, via regulation of the main generator and auxiliary generator/motor, so as to always maintain an inlet temperature to the heat exchanger below a predetermined maximum allowable temperature for the heat exchanger.

28. The method of claim 24, wherein the combustor comprises a catalytic combustor, the method further comprising the step of regulating the rotational speeds of the first and second spools, via regulation of the main generator and auxiliary generator/motor, so as to always maintain an inlet temperature to the combustor at or above a catalyst minimum temperature necessary for proper operation of the combustor.

29. The method of claim 17, further comprising the step of starting the engine, wherein during starting the auxiliary generator/motor is operated in the motor mode to rotatably drive the spool to which the auxiliary generator/motor is coupled.

30. A turbocharged engine system, comprising:

an engine operable to combust a mixture of air and fuel so as to produce hot combustion gases and operable to expand the combustion gases so as to produce mechanical power, the engine having an intake for receiving air to be mixed with fuel and having an exhaust for discharging expanded combustion gases;

a turbocharger comprising a rotary compressor mounted on a shaft and a turbine mounted on the shaft, the compressor being operable to compress air and supply the air to the intake of the engine, the turbine arranged to receive expanded combustion gases from the exhaust of the engine and further expand the gases to produce mechanical power that drives the shaft

a main generator arranged to be driven by the engine, the main generator operable to produce electrical current for supply to a load; and

an auxiliary generator/motor arranged to be driven by the shaft of the turbocharger, the auxiliary generator/motor selectively operable in either a generation mode or a motor mode, the auxiliary generator/motor in the generation mode being operable to extract mechanical power from the turbocharger and generate an alternating electrical current for supply to the load, the auxiliary generator/motor in the motor mode being operable to receive electrical power from a source and convert the electrical power into mechanical power that is injected into the turbocharger.

31. The turbocharged engine system of claim 30, further comprising a controller structured and arranged to control operation of the main generator and the auxiliary generator/motor.

32. The turbocharged engine system of claim 30, wherein the engine comprises a reciprocating engine.